



# Improvements in Aircraft Fire Detection

May 2018

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# *Motivation*

- ❖ **Need for timely fire detection in cargo compartments on board aircrafts**
- ❖ **Reduce proportion of nuisance alarms from fire detection systems**
- ❖ **Scope**
  - **Cargo compartments**
  - **Hidden spaces (wall cavities, ceiling spaces)**

# Overview

## ❖ Background study completed

- Requirements for detection in FAR
- Nuisance:fire source ratios
- Configuration of spaces
- Detection technologies

## ❖ Experimental portion of project initiated

- Small-scale tests at UMD
- Planning for full-scale tests at FAA underway



# *Fire Detection Challenges: Cargo Compartments*

- ❖ **Response time (FAA Regs): 1 minute after ignition**
  - **Fire source not identified**
    - fuel composition?
    - combustion mode?
  
- ❖ **No detection requirements for fires originating within ULDs under FAR regulations**
  - **Time delay to detect fire that originates within ULD (until breach of ULD)**



# *Experiments: Cargo Compartments*

- ❖ **Two phases**
  - **Small-scale at UMD**
  - **Full-scale at FAA Tech Center**
- ❖ **Wide variety of fire and nuisance sources**
- ❖ **Variety of detection technologies**
  - **Heat**
  - **Smoke**
  - **Gas**
- ❖ **Assess performance of detectors located within ULD's vs. in cargo compartment**



# *Small-scale Tests*

## ❖ Enclosure

- 0.91 m x 0.91 m x 0.91 m

## ❖ Instrumentation:

- Thermocouples
- Light obscuration
- Load cell



# *Fire and Nuisance Sources*

## ❖ Tests Run:

- 12  $\Omega$  resistor at 120 V
- Heated wire (2 m)
- Smoke pellet on propane burner
- Wood chips (20 g) on propane burner
- Heptane (10 mL)
- Suitcase (.076 m x .076 m nylon sample)

## ❖ Future tests:

- Shredded paper
- Polyurethane foam
- Nuisance sources (e.g. boiling water)



# *Experiments: Hidden Areas*

- ❖ **Two phases**
  - **Small-scale at UMD**
  - **Full-scale at FAA Tech Center**
- ❖ **Wide variety of fire and nuisance sources**
- ❖ **Variety of detection technologies**
  - **Heat**
  - **Smoke**





# *Small-scale Tests*

## ❖ Enclosure

- 0.91 m x 0.91 m x 0.10 m

## ❖ Instrumentation:

- Thermocouples
- Load cell

## ❖ Fire sources:

- Hot wire
- Wood chips
- Shredded paper
- Polyurethane foam

